# Lessons learned from long term water resources plans: top town vs. bottom up

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# Outline

- Why and what to compare?
- Top down vs. bottom up
- Comparison of water plans
  - Purposes
  - Populations
  - Water demands
  - Water supplies
  - Strategies for securing water supplies
- Summary

# Why and what to compare?

- Share experiences and lessons learned

- Similarity and differences
  - Needs/purposes for water planning
  - Population projections
  - Water demands vs. supply
  - Strategies for securing water supplies

# Top down vs. bottom up
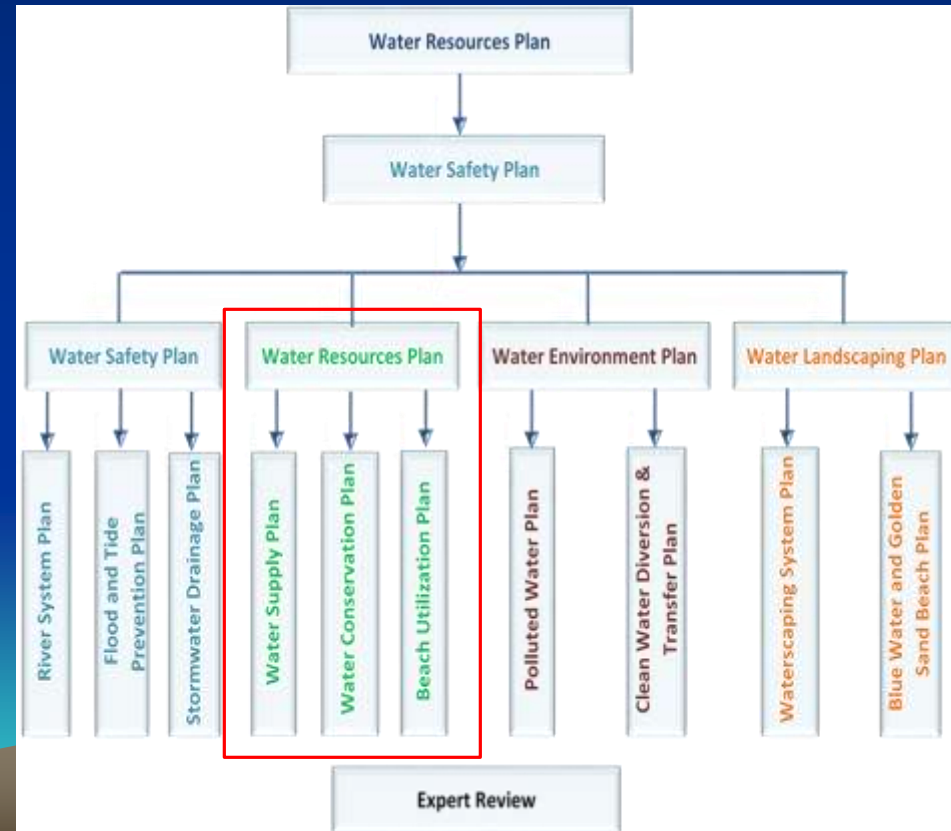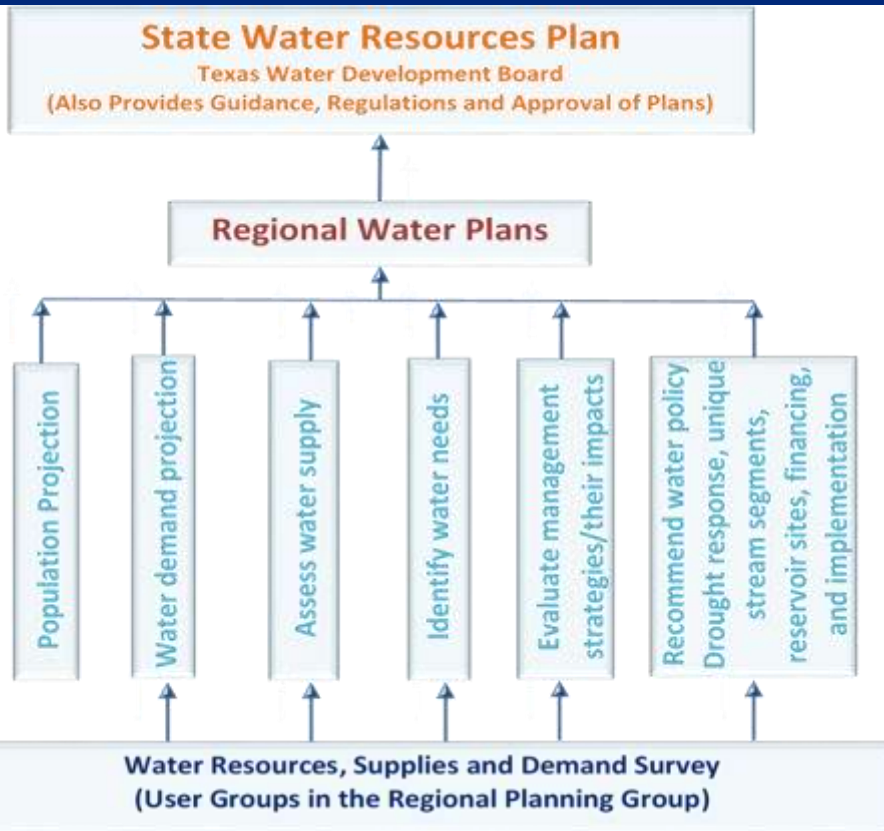
# Background



Houston /Region H

Shanghai

# Background

## Houston/Region H

Area: 36,080 km$^2$

Climate: humid subtropical

Pop.: 6 million (mega-city to be)

GDP: $308.7 billion in 2005

GDP: $503.31 billion in 2015



Economy of Houston

- natural resources and mining
- construction
- manufacturing
- trade, transportation and utilities
- information
- financial activities
- professional and business services
- educational and health services
- leisure and hospitality
- other services
- government

3%, 8%, 9%, 21%, 2%, 6%, 14%, 11%, 8%, 4%, 14%

## Shanghai

Area: 6,340 km$^2$

Climate: humid subtropical

Pop: 23 million (mega city)

GDP:1,716.6 billion RMB
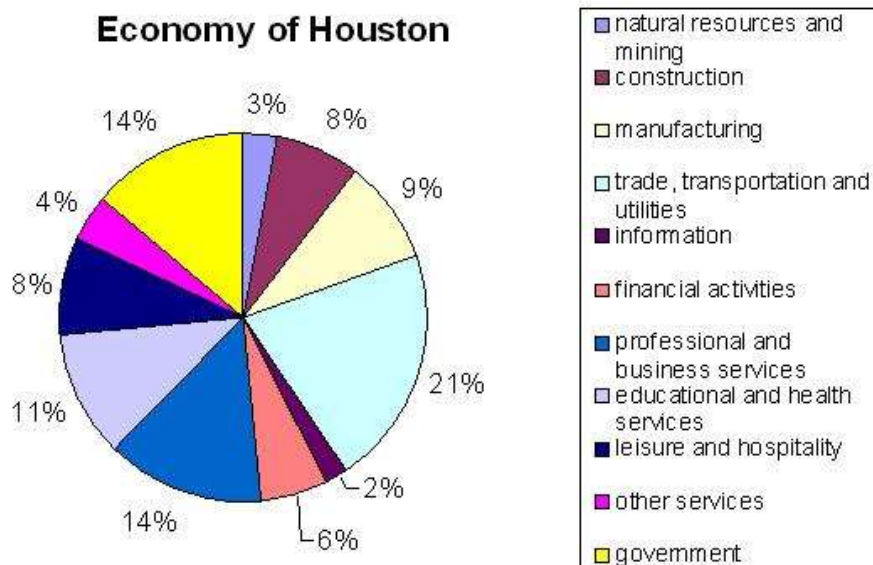
- GDP growth:10.3%
- Fixed Asset Investment: 531.80 billion RMB
- Utilized Foreign Direct Investment: $11.1 billion
- Imports: $188.1 billion
- Exports: $180.8 billion

# Challenges

- Population growth
- Growing water demands vs. inadequate water supplies
- Water quality deterioration
- Land subsidence
- Droughts

# Water Resources Plan

## Houston/Region H

- 50 yr. plan for drought contingency
- 5 year cycle
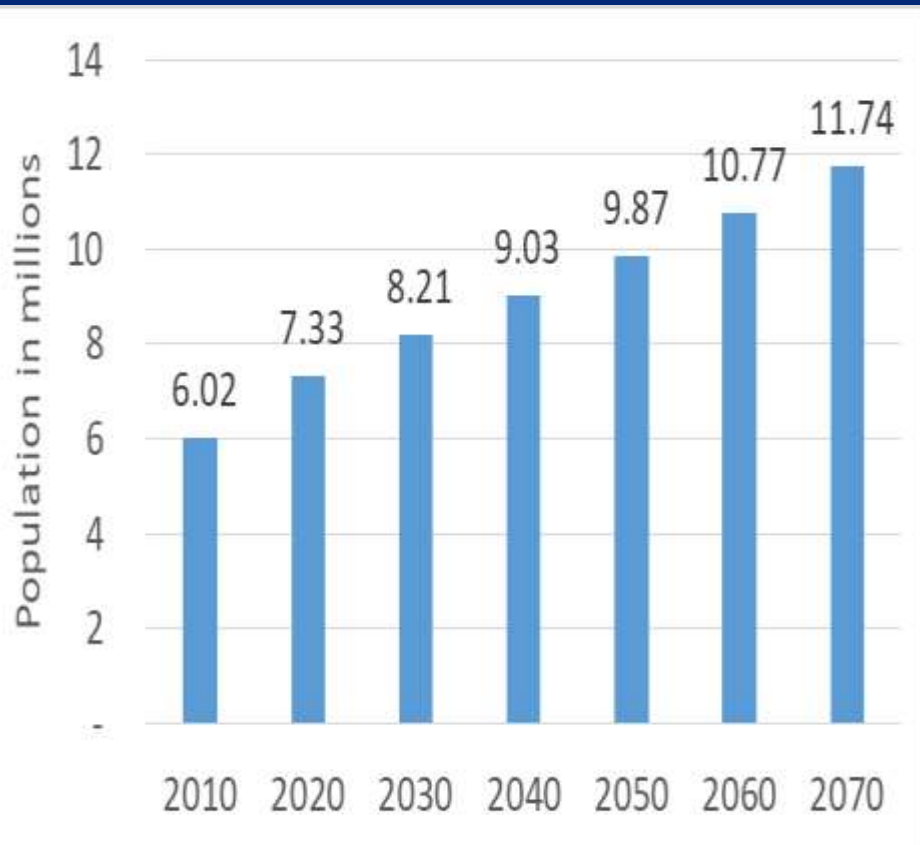- From top down to bottom up

## Shanghai

- 20 yr. water resources plan
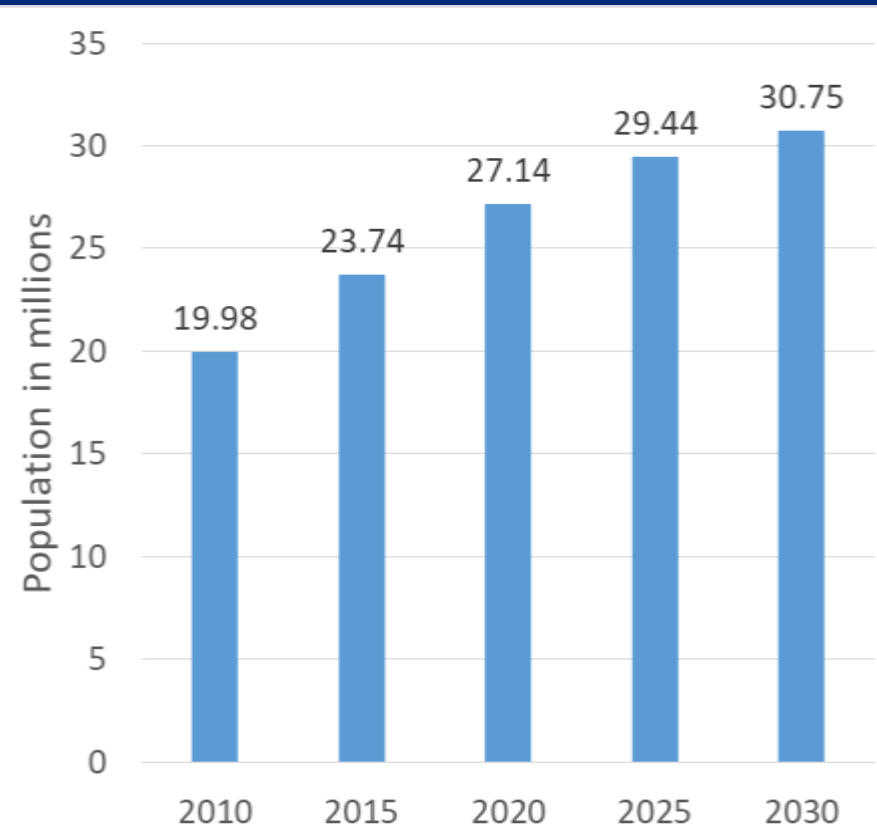- Update irregularly ( 5 to 10 years)
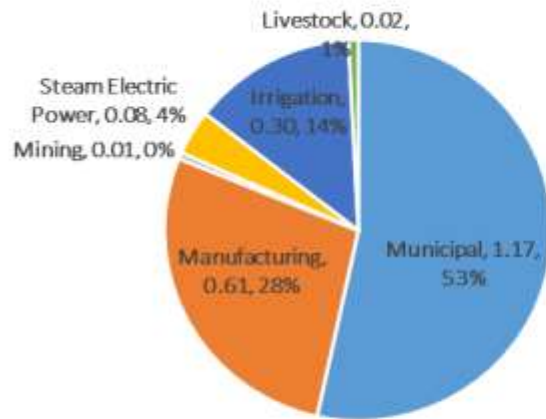- Top down
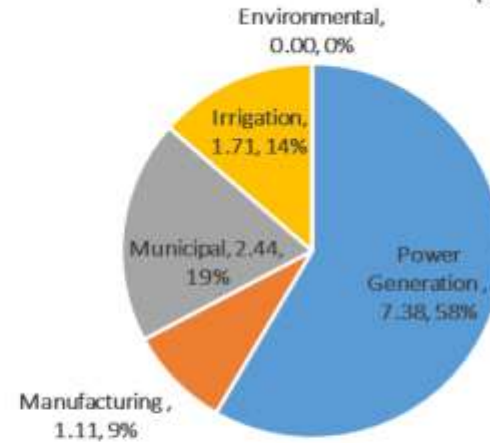
# Population Projection

Houston (Region H)

Shanghai

# Water Demand

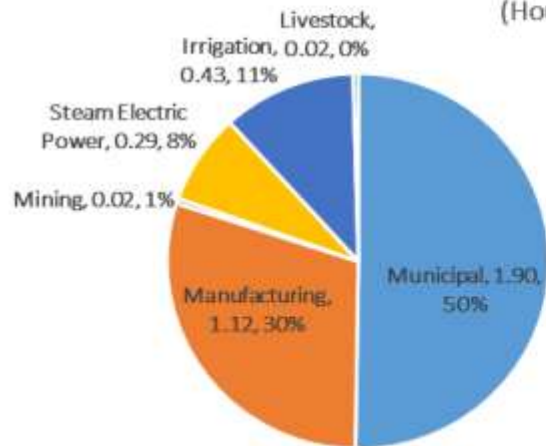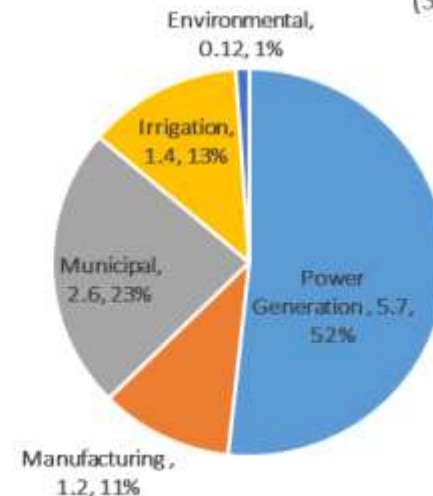# Available Surface Water Supplies

## Houston/Region H

Trinity River (59 %):  1.93
Brazos River (22 %):  0.71
Others (19%):  0.64

**Subtotal  (BCM)    3.28**

(TDDB 2017)

## Shanghai

Yangtze River (34%):  4.09
Huangpu River (38%): 5.57
Others (28%):  3.36

**Subtotal (BCM)    13.02**

(Xuefeng Li and Changlai Han,2007)

# Available Groundwater Supplies
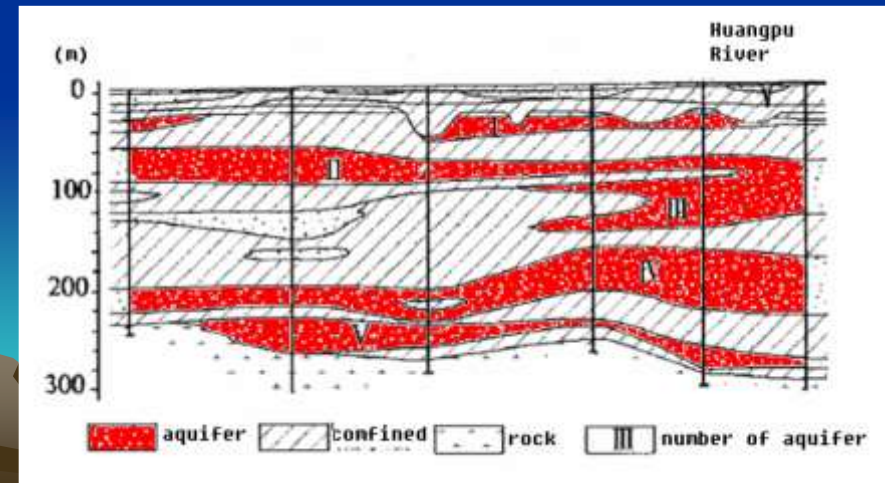
## Houston/Region H

Gulf Coastal (90%):        1.0
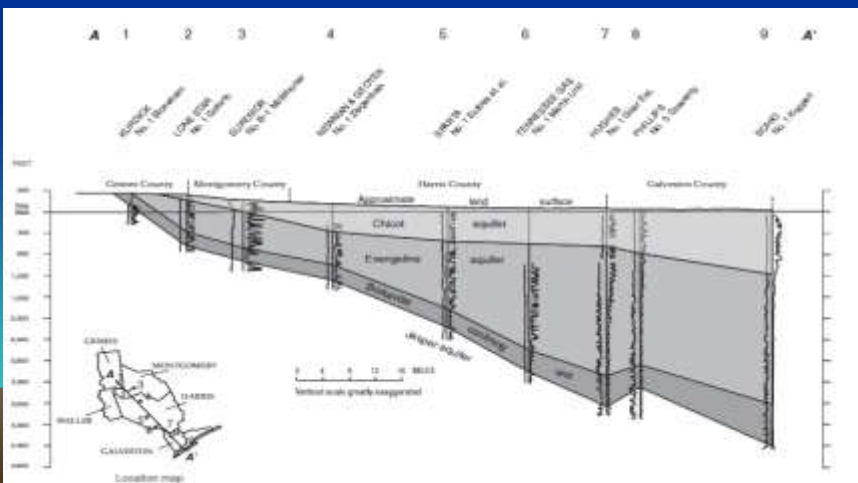Brazos Alluvium (5%):   0.46
Other aquifers (5%):       0.48

TWDB 2017

## Shanghai

0.142 billion cubic meters
From the $2^{nd}$, $3^{rd}$, $4^{th}$, and $5^{th}$ aquifers

Yuan, 2003

# Water Shortage

## Houston/Region H

- Water quantity - drought

- Subsidence control

- Deteriorated infrastructures

## Shanghai

- Water quality

- Subsidence control

- Three redlines control

# Water Strategy 1: Water conservation

## Houston/Region H

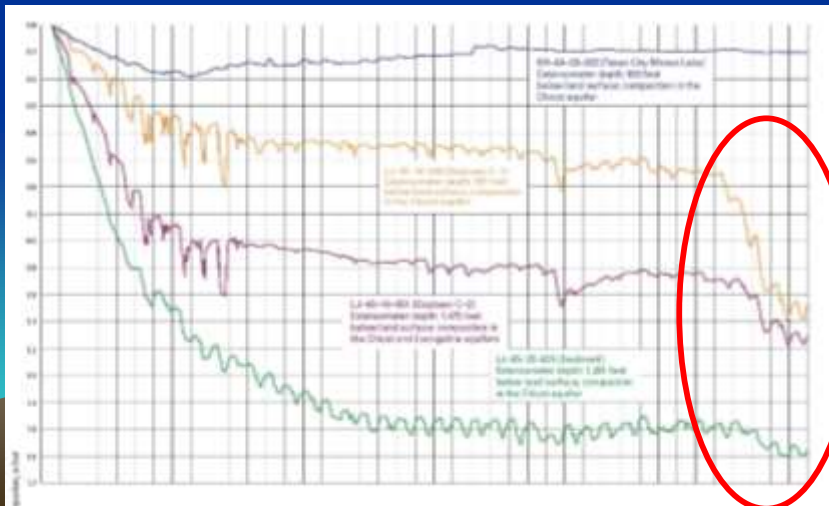## Shanghai

- Industrial conservation

- Irrigation conservation

- Municipal conservation

# Water Strategy 2: Groundwater uses

## Houston (USGS)
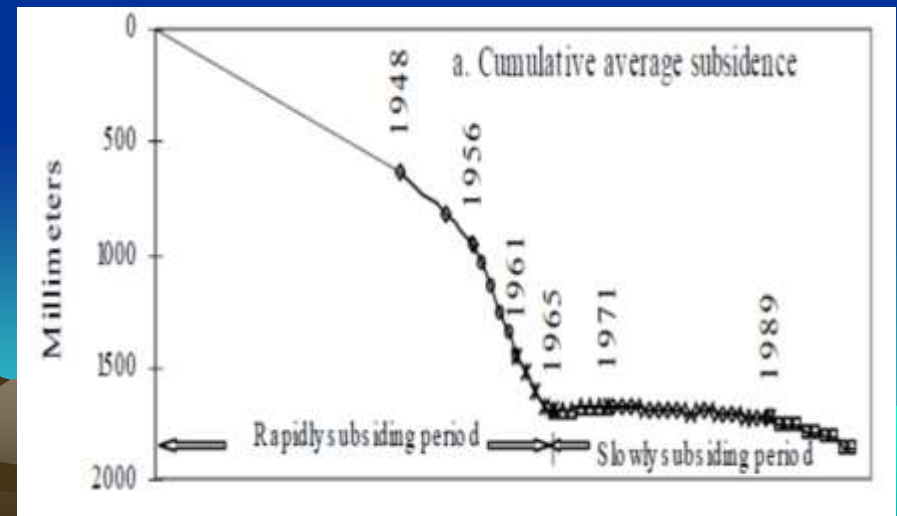
- Expanded use of groundwater during drought

- Interim groundwater use

- Initiatives for Managed Aquifer Recharge

## Shanghai (SGSB)

- New groundwater wells for drinking and livestock in rural area

- Artificial injection to control land subsidence
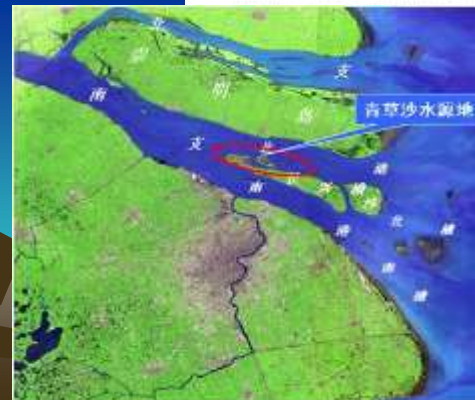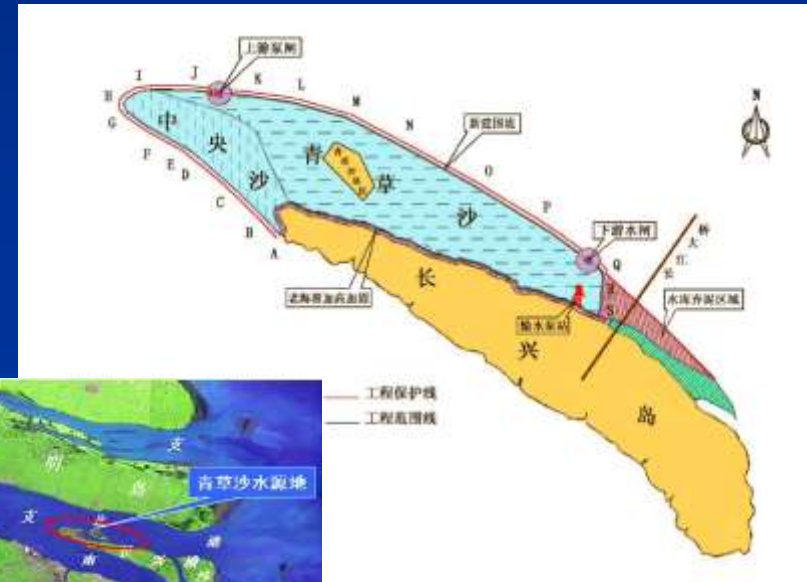
# Other Water Strategies

## Houston/Region H

- Wastewater Reuse

- New Reservoirs

## Shanghai

- Wastewater Reuse

- New Reservoirs

# Comparison of components of two water plans

| Requirement/Context | Houston (Region H) | Shanghai |
|---|---|---|
| Objectives/purposes | Drought contingency | Part of the comprehensive water resources plan |
| Population projection | TWDB recommended & modified by the planning group as needed | Based on national census & adjusted as needed to account for migrant residents |
| Projection of water demands | Projection based on per capita water use for urban water and surveys of other water users | Living/residential water use: per capita based on population; Agricultural and forest water uses, industrial uses as well as ecosystem water needs based on survey |
| Assessment of water supplies | Survey of current water supplies & project future water supplies | Survey of current water supplies and projection of future water supplies |
| Identify water shortage/surplus | Difference between water supplies and demands by user group under drought conditions | Identify needs for additional water supplies by comparing water demands and supplies. |
| Identify management strategies and evaluate impacts of each strategy | Water conservation, surface water transfer, reuse of reclaimed water, aquifer storage and recovery; economic-social, environmental impacts | Specific plans for water conservation; Storm water discharge, wastewater treatment, clean water diversion & transfer to meet the requirements of national water policy: three red lines |
| Recommend changes in water policy | Potential changes to regional water planning guide and rules as well as state water policy | Amendments to the water resources planning guidelines and rules by the central government |
| Implementation | By water providers with loan from TWDB: State Water Implementation Fund for Texas (SWIFT) | Shanghai Bureau of Water Resources |
| Monitoring and post assessment | Financial and implementation report | Included in the plan |

modified form Sheng, Michelsen & Liu, 2015

# Summary

- Similar challenges: growth pains and uncertain climate conditions, environmental constraints

- Different planning approaches: bottom up vs. top down; different planning horizon

- Lower demands: water conservation-key strategy

- Alternative water resources: local vs. other

- Sharing and exchange for advances in science and technology

Thank You!

USDA NIFA – Hatch Project

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http://elpaso.tamu.edu/research